CLAIMS:

1. A method of forming a capacitor on a substrate in a semiconductor device, comprising: 6,096,592

forming a first layer of a conductive material over said substrate; 5,980,977

forming a second layer of a dielectric over said first layer; 6,010,969

contacting said second layer with hydrogen, oxygen and nitrous oxide 5,994,756 gases so as to form an oxidation layer over said second layer; and

forming a third layer of conductive material over said second layer. 6,207,589

6,414,348

6,319,766

2. The method of claim 1, wherein said second layer is formed to a thickness not exceeding about 60 Angstroms.

3. The method of claim 1, wherein said second layer is formed to a thickness not exceeding about 50 Angstroms.

4. The method of claim 3, wherein said second layer is formed to a thickness within the range of about 45 to 50 Angstroms.

5. The method of claim 1, wherein the ratio of nitrous oxide to oxygen and hydrogen respectively is in the range of about .05 to about 1.7.

6. The method of claim 5, wherein said contacting is performed with a gas flow rate of at least about 0.5 slm for said nitrous oxide.

7. The method of claim 6, wherein said contacting is performed with a gas flow rate of at least about 2.5 slm for said nitrous oxide.

8. The method of claim 7, wherein said contacting is performed with a gas flow rate of at least about 5 slm for said nitrous oxide.

9. The method of claim 1, wherein said contacting is performed at a temperature within the range of about 600 to 1000°C.

10. The method of claim 9, wherein said contacting is performed at a temperature within the range of about 700 to 900 °C.

11. The method of claim 10, wherein said contacting is performed at a temperature within the range of about 700 to 800 °C.

12. The method of claim 1, wherein said oxidation layer is formed so as to be thinner than said dielectric layer.

13. The method of claim 12, wherein said oxidation layer is formed to a thickness less than about 5 Angstroms.

14. The method of claim 12, wherein said oxidation layer is formed to a thickness less than about 3 Angstroms.

15. The method of claim 1, wherein said contacting is performed is performed with a gas flow rate within the range of about 1 to 15 slm for each of said hydrogen, oxygen and nitrous oxide gases.

16. The method of claim 15, wherein said contacting is performed with a gas flow rate within the range of about 2 to 10 slm for each of said hydrogen, oxygen and nitrous oxide gases.

17. The method of claim 16, wherein said contacting is performed at a temperature within the range of about 600 to 1000°C.

18. The method of claim 17, wherein said contacting is performed at a gas flow rate for said oxygen which is within the range of about 4 to 8 slm.

19. The method of claim 18, wherein said contacting is performed at a gas flow rate for said hydrogen which is within the range of about 4 to 8 slm.

20. The method of claim 19, wherein said contacting is performed at a gas flow rate within the range of about 4 to 8 slm for each of said oxygen and hydrogen.

21. The method of claim 17, wherein said contacting is performed at a gas flow rate within the range of about 2.5 to 10 slm.

22. The method of claim 21, wherein said contacting is performed at a gas flow rate within the range of about 6 to 10 slm.

23. The method of claim 17, wherein said contacting is performed at a temperature within the range of about 700 to 800°C.

24. The method of claim 23, wherein said contacting is performed at a temperature of about 750°C.

25. The method of claim 23, wherein said contacting is performed at a gas flow rate for said hydrogen of about 6 slm.

26. The method of claim 25, wherein said contacting is performed at a gas flow rate for said oxygen of about 6 slm.

27. The method of claim 25, wherein said contacting is performed at a gas flow rate for said nitrous oxide of about 2.5 slm.

28. The method of claim 23, wherein said contacting is performed at a gas flow rate for said nitrous oxide of about 5 slm.

29. The method of claim 23, wherein said contacting is performed at a gas flow rate for said nitrous oxide of about 10 slm.

30. The method of claim 24, wherein said contacting is performed at a gas flow of about 6 slm for said hydrogen, about 6 slm for said oxygen, and about 2.5 slm for said nitrous oxide.

31. The method of claim 24, wherein said contacting is performed at a gas flow rate of about 6 slm for said hydrogen, about 6 slm for said oxygen, and about 5 slm for said nitrous oxide.

32. The method of claim 24, wherein said contacting is performed at a gas flow rate of about 6 slm for said hydrogen, about 6 slm for said oxygen, and about 10 slm for said nitrous oxide.

33. The method of claim 24, wherein said contacting is performed at a gas flow rate of about 6 slm for said hydrogen, about 6 slm for said oxygen, and within the range of about 1 to 15 slm for said nitrous oxide.

34. The method of claim 33, wherein said contacting is performed at a gas flow rate of about 6 slm for said hydrogen, about 6 slm for said oxygen, and within the range of about 2 to 10 slm for said nitrous oxide.

35. The method of claim 23, wherein said second layer is formed to a thickness of about 47 Angstroms.

36. The method of claim 24, wherein said second layer is formed to a thickness of about 47 Angstroms.

37. The method of claim 34, wherein said second layer is formed to a thickness of about 47 Angstroms.

38. The method of claim 35, wherein said oxidation layer is formed to be thinner than said dielectric layer.

39. The method of claim 36, wherein said oxidation layer is formed to a thickness less than about 5 Angstroms.

40. A method of forming a capacitor structure in a semiconductor device, comprising:

depositing a layer of silicon nitride over a conductive layer formed over a substrate;

contacting said silicon nitride layer with hydrogen, oxygen and nitrous oxide gases so as to form an oxidation layer over said silicon nitride layer.

41. The method of claim 40, further comprising forming a second conductive layer over said oxidation layer.

42. The method of claim 41, wherein said second conductive layer is formed of polysilicon.

43. The method of claim 40, wherein said silicon nitride layer is deposited to a thickness not exceeding about 60 Angstroms.

44. The method of claim 43, wherein said silicon nitride layer is deposited to a thickness not exceeding about 50 Angstroms.

45. The method of claim 44, wherein said contacting is performed at a flow rate for said nitrous oxide within the range of about 1 to 10 slm.

46. The method of claim 45, wherein said contacting is performed at a flow rate for said oxygen at a flow rate within the range of about 4 to 8 slm.

47. The method of claim 46, wherein said flow rate for said nitrous oxide is greater than the flow rate for said oxygen.

48. The method of claim 47, wherein the ratio of nitrous oxide to oxygen and hydrogen respectively is in the range of about 0.05 to about 1.7..

49. The method of claim 48, wherein said flow rate for said nitrous oxide is at least greater than the flow rate for said oxygen.

50. The method of claim 40, wherein said contacting is performed at a temperature within the range of about 700 to 800°C.

51. The method of claim 50, wherein said contacting is performed at a gas flow rate for each of said hydrogen and oxygen gases which is within the range of about 4 to 8 slm.

52. The method of claim 51, wherein said contacting is performed at a gas flow rate for said nitrous oxide gas which is at least about 2.5 slm.

53. The method of claim 52, wherein said contacting is performed at a gas flow rate for said nitrous oxide which is at least about 5 slm.

54. The method of claim 53, wherein said contacting is performed at a gas flow rate for said nitrous oxide which is at least about 10 slm.

55. The method of claim 52, wherein said contacting is performed at a gas flow rate for each of said hydrogen and oxygen gases which is about 6 slm.

56. The method of claim 50, wherein said silicon nitride layer is deposited to a thickness of about 45 to 50 Angstroms.

57. The method of claim 56, wherein said oxidation layer is formed to a thickness less than about 5 Angstroms.

58. The method of claim 57, wherein said oxidation layer is formed to a thickness less than about 3 Angstroms.

59. The method of claim 50, wherein said contacting is performed at a gas flow rate of about 6 slm for each of said hydrogen and oxygen gases, and at a gas flow rate within the range of about 2.5 to 10 slm for said nitrous oxide gas.

60. A method of oxidizing a dielectric in a capacitor in an intermediate stage of fabrication comprising: exposing said dielectric to a combination of hydrogen, oxygen and nitrous oxide gases, and increasing the flow rate of said nitrous oxide gas while maintaining the flow rate of said hydrogen and oxygen gases substantially constant.

61. The method of claim 60, wherein said flow rate of said nitrous oxide gas is increased over the range of from about 2.5 slm to about 10 slm.

62. The method of claim 61, wherein said exposing is performed at a hydrogen flow rate within the range of about 5 to 7 slm.

63. The method of claim 61, wherein said exposing is performed at an oxygen flow rate within the range of about 5 to 7 slm.

64. The method of claim 60, wherein said nitrous oxide flow rate is at least about 1 ½ times greater than the flow rates of each of said hydrogen and oxygen gases.

65. A method of forming an oxidized layer on a dielectric material, which comprises exposing said dielectric material to a combination of hydrogen, oxygen and nitrous oxide gases.

66. The method of claim 65, wherein said forming is effected at a temperature within the range of about 500 to 1000 C, a flow rate for said hydrogen of about 4 to 8 slm, a flow rate for said oxygen of about 4 to 8 slm, and a flow rate for said nitrous oxide of at least about 0.5 slm.

67. The method of claim 66, wherein said forming is effected at atmospheric pressure.

68. The method of claim 67, wherein said forming is effected at a temperature within the range of about 700 to 800°C.

69. The method of claim 68, wherein said forming is effected at a flow rate for said nitrous oxide of at least about 5 slm.

70. The method of claim 69, wherein said forming is effected at a flow rate for said nitrous oxide of at least about 10 slm.

71. The method of claim 67, wherein said oxidized layer is formed to a thickness less than that of said dielectric material.

72. The method of claim 71, wherein said oxidized layer is formed to a thickness less than about 5 Angstroms.

73. The method of claim 71, wherein said oxidized layer is formed to a thickness less than about 3 Angstroms.

74. The method of claim 73, wherein said flow rate for said nitrous oxide is about 0.05 to about 1.7 times the flow rate for each of said hydrogen and oxygen gases.

75. The method of claim 74, wherein said flow rate for said nitrous oxide is at least greater than the flow rate for each of said hydrogen and oxygen gases.

76. A semiconductor device, comprising:

a substrate;

a capacitor formed over said substrate, said capacitor including:

first and second conductive layers;

a capacitor dielectric formed between said first and second conductive layers;

said dielectric including an oxidation layer formed by an oxidation of said dielectric in the presence of hydrogen, oxygen and nitrous oxide gases.

77. The device of claim 76, wherein said dielectric is not greater than about 60 Angstroms in thickness.

78. The device of claim 77, wherein said dielectric is not greater than about 50 Angstroms in thickness.

79. The device of claim 78, wherein said dielectric is between 45 – 50 Angstroms in thickness.

80. The device of claim 78, wherein said semiconductor device is a memory device.

81. A processor based system comprising:

a processor; and

an integrated circuit device coupled to said processor, at least one of said processor and integrated circuit device containing a capacitor comprising:

first and second conductive layers, a dielectric layer between said conductive layers and an oxidation layer over said dielectric layer, said oxidation layer

being formed by an oxidation of said dielectric layer in the presence of a combination of hydrogen, oxygen and nitrous oxide gases.

82. The system of claim 81, wherein said first and second conductive layers are formed of polysilicon.

83. The system of claim 82, wherein said oxidation layer is less than about 5 Angstroms in thickness.

84. The system of claim 83, wherein said dielectric layer does not exceed about 50 Angstroms in thickness.

85. The system of claim 84, wherein each of said layers is formed over a substrate.

86. A memory cell of a semiconductor memory device, comprising:

a capacitor; said capacitor including first and second conductive layers, a dielectric layer between said conductive layers and an oxidation layer over said dielectric layer, said oxidation layer being formed by an oxidation of said dielectric layer in the presence of a combination of hydrogen, oxygen and nitrous oxide gases; and

an access transistor for accessing said capacitor.

87. A memory cell of claim 83, wherein said capacitor is a container capacitor.

88. A memory cell of claim 87, wherein said dielectric layer is comprised of silicon nitride.

89. A memory cell of claim 88, wherein said dielectric layer is less than about 50 Angstroms in thickness.

90. A memory cell of claim 89, wherein said dielectric layer is thinner than said first conductive layer.

91. A memory cell of claim 90, wherein said first and second conductive layers are comprised of polysilicon.

92. A memory cell of claim 86, wherein said capacitor is formed in an opening in an insulative layer.

93. A memory cell of claim 92, wherein said access transistor comprises a conductive plug formed in a contact opening.

94. A memory cell of claim 93, wherein said conductive plug is formed between a pair of gate stacks.

95. A memory cell of claim 94, wherein said access transistor provides access to a source/drain region formed in a substrate.